Title: DIAPHRAGM PUMP
Applicant: Peter JAHN et al. Serial No.: 10/697,529
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REPLACEMENT SHEET

Fig. 3

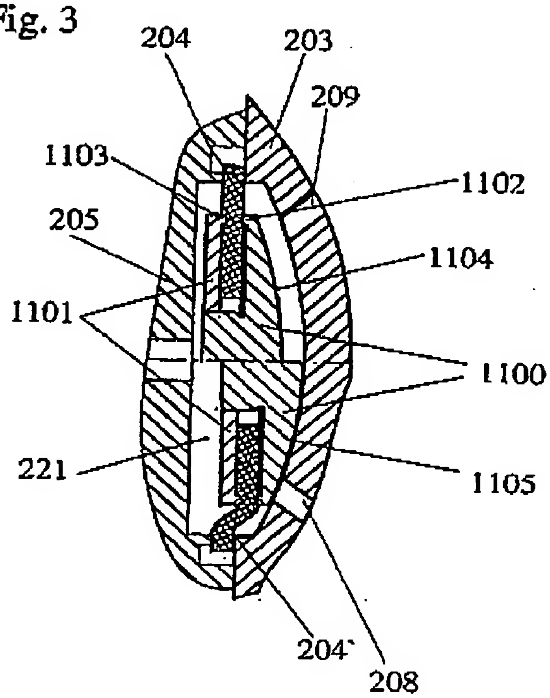


Fig. 3b

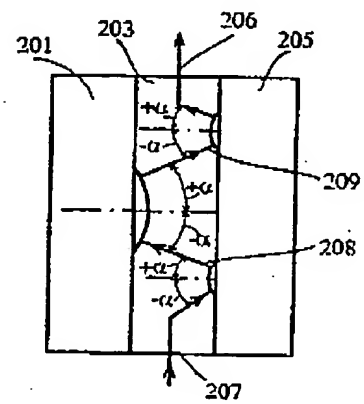


Fig. 9

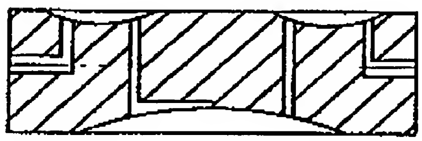


Fig. 9a

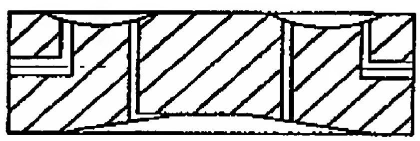


Fig. 9b

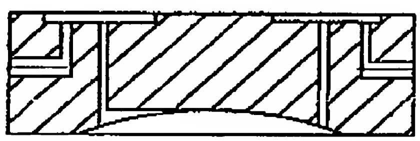


Fig. 9c

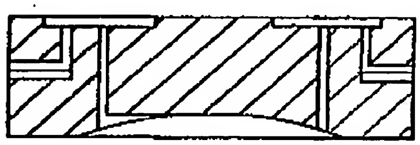
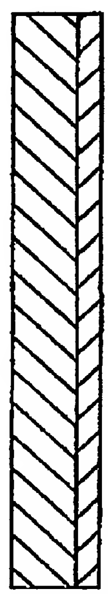


Fig. 10



Heat exchanger calculations

Hydraulic diameter

The hydraulic diameter, d_h, is used instead of the geometrical diameter for channels of non-circular shape.

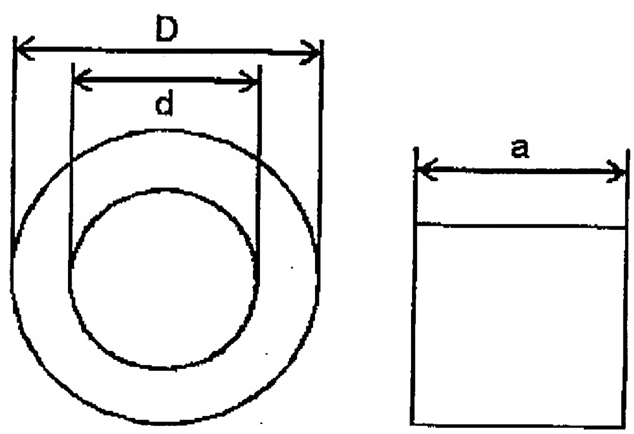
d_h is defined as:

$$d_h = \frac{4 \cdot \text{cross-sectional area}}{\text{wetted perimeter}}$$

For different geometries d_h becomes:

circular tube

$$d_h = \frac{4 \cdot \frac{\pi \cdot d^2}{4}}{\pi \cdot d} = d$$



square tube

$$d_h = \frac{4 \cdot a^2}{4 \cdot a} = a$$

two concentric tubes

$$d_h = \frac{4 \cdot \left(\frac{\pi \cdot D^2}{4} - \frac{\pi \cdot d^2}{4}\right)}{\pi \cdot D + \pi \cdot d} = D - d$$

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Principles of a heat exchanger

Logarithmic mean temperature and theta value